

## New species of the genus *Terpnacarus* Grandjean (Acari: Terpnacaridae) with notes on the biology of one species

by

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Notes on the genus *Terpnacarus* are given together with descriptions of two new species, *T. glebulentus* and *T. carolinaensis*, and an account of the life history of the first species.

### INTRODUCTION

The genus *Terpnacarus* was proposed by Grandjean (1939) with *T. bouvieri* as the type species. This species was redescribed by Shiba (1968), and in the same paper Shiba described another species, *T. variolus*. Weis-Fogh (1947-8) briefly described the species *T. subterraneus*, which closely resembles *T. bouvieri*. A recent examination of the type specimen of *Hybalicus piliger* at the Berlese collection in Florence revealed that this species belongs, without doubt, to *Terpnacarus*. Although the specimen is partly damaged the characteristics of the palpal tarsus, legs and prodorsum are typically those of the genus *Terpnacarus*. There is also no doubt that the species *Hybalicus gibbosus*, which was described and illustrated by Womersley (1944), actually belongs to the genus *Terpnacarus* because of the details of the dorsum, the yatagan-shaped solenidion at the tip of the palpal tarsus, the elongated claws and empodia, and the shape of the body setae.

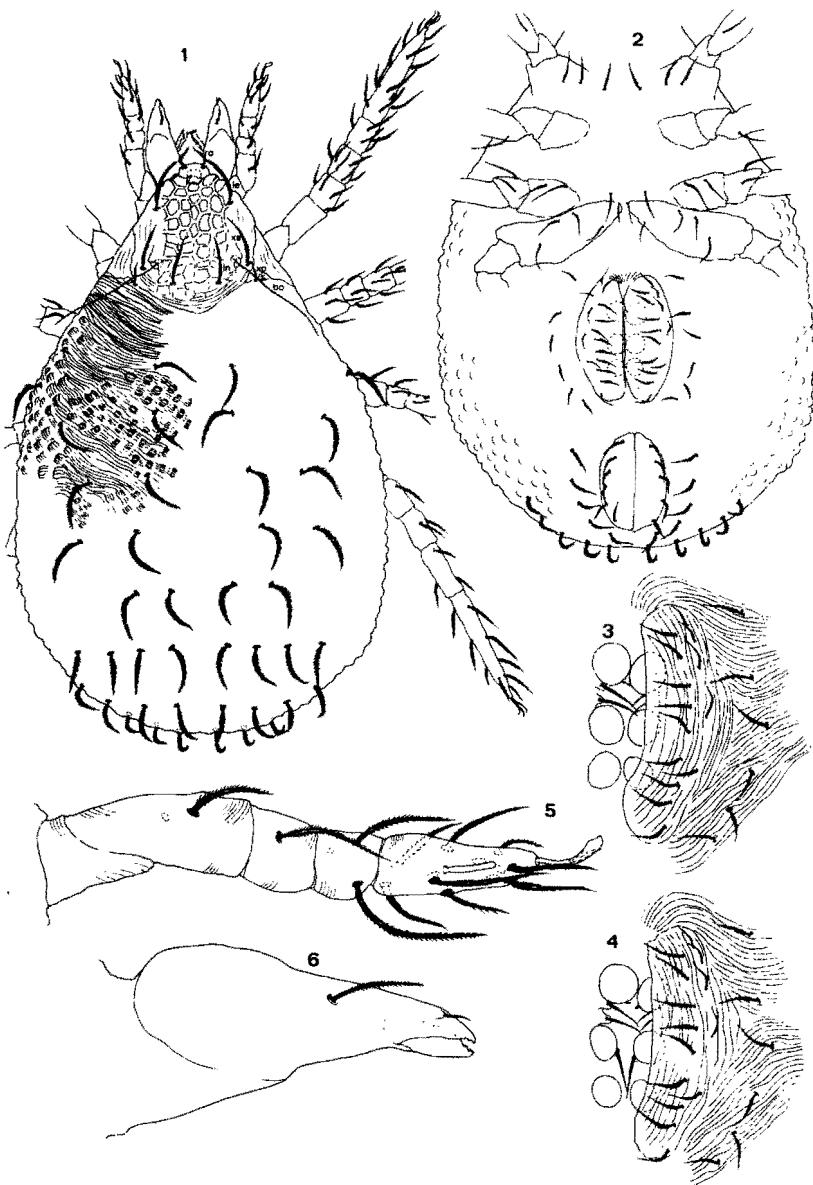
The type material of the species described in this paper is deposited in the collection of the Institute for Zoological Research, Potchefstroom University and the Acarology Section of the Plant Protection Research Institute, Dept. of Agricultural Technical Services, Pretoria.

### *TERPNACARUS* Grandjean

***Terpnacarus* Grandjean, 1939: 1-122; Weis-Fogh, 1947-8: 261-2**

Type species: *Terpnacarus bouvieri* Grandjean, 1939.

The following are the characteristics of this genus: small (adults 350-380 µm long) and of a white to yellowish colour; prodorsum with 6 pairs of setae, *ro*, *le*, *xa*, *xp* and *in* as well as sensillae *bo*; prodorsum without a definite sensory area but tapering



Figs 1–6 *Terpnacarus glebulentus* spec. nov., female. 1. Dorsum. 2. Venter. 3. Genital Opening (group 1). 4. Genital opening (group 2). 5. Palp. 6. Chelicera.

into a large naso bearing a large lenslike median eye ventrally; one pair of small lateral eyes present; integument with smooth striae forming an undulating pattern especially on the prodorsum; hysterosoma divided into 8 transverse segments; body setae plumose, curved and situated in transverse rows; chelicerae bulky with opposed, dentate chelae; adults with 3 pairs of genital papillae; 3 nymphal stages present; hypognathum with prominent ectomala (rutella); femur I completely divided, femur III partly divided and femur IV partly or completely divided; fourth pair of legs elongate and adapted for jumping.

#### Key to the South African species of *Terpnacarus*

- 1 Hysterosomal integument striate and with numerous tubercles, dorsal hysterosoma with 21 pairs of setae ..... **T. glebulentus** spec. nov.
- Hysterosomal integument finely striate but smooth, dorsal hysterosoma with 23 pairs of setae ..... **T. carolinaensis** spec. nov.

#### *Terpnacarus glebulentus* spec. nov., figs 1–23

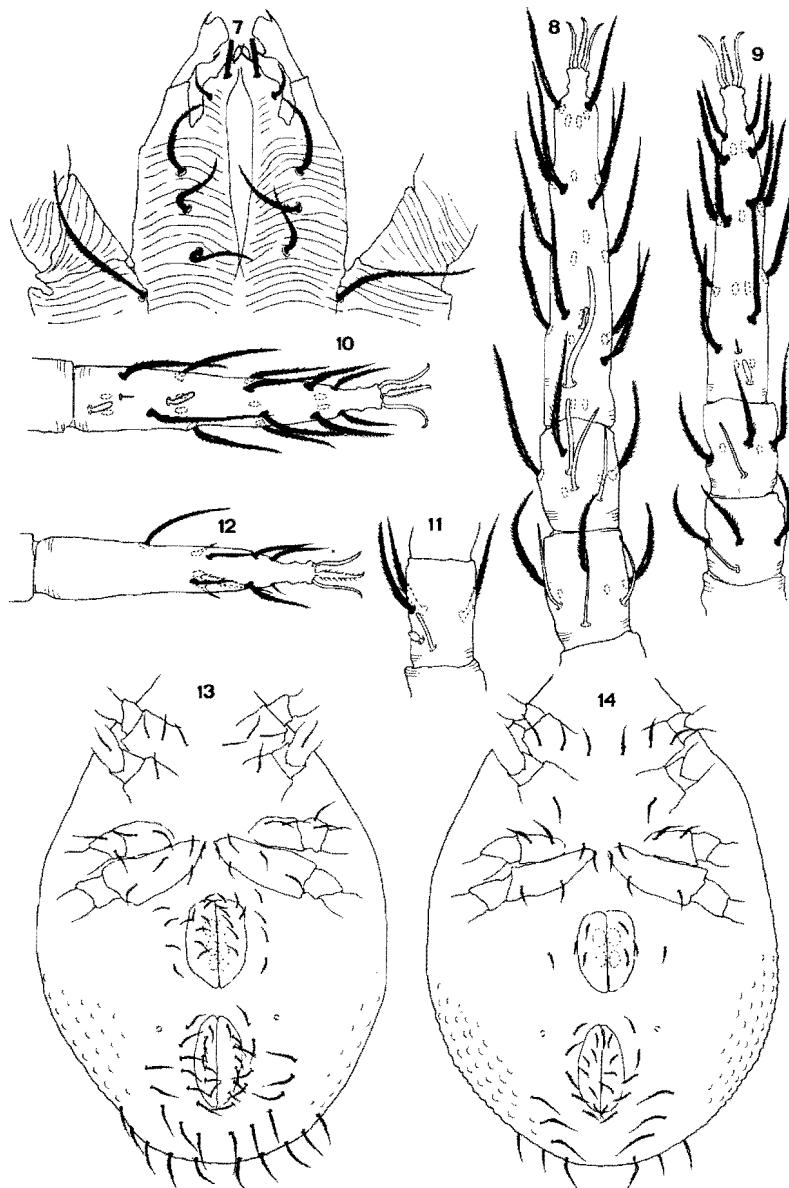
The integumental pattern as well as the shape and position of the body setae closely resembles that of *T. variolus* Shiba. However, the new species can be distinguished from the latter by the details of the legs, hypognathum and pedipalpi.

**FEMALE** (figs 1–12 and 18–23). Dimensions: length of body (incl. gnathosoma) 352–79 µm; length of body (excl. gnathosoma) 310–22 µm; breadth of body 196–206 µm.

**Dorsum** (figs 1 and 18–20). Setae *le*, *xa* and *in* are more or less of equal length, while setae *xp*, which are situated immediately medially to the eyes, are less than half the length of the first mentioned setae (figs 1 and 18). Setae *ro* are about two-thirds the length of setae *le*, *xa* and *in* and are situated on the naso. The naso (fig. 19) is large, covered dorsally with smooth, transverse striae and bears a large lenslike eye ventrally. The lateral eyes are very small and difficult to detect. Sensillae *bo* are filamentous, finely ciliate, 63–7 µm long and situated 43–4 µm apart. As illustrated in fig. 18, the central part of the prodorsum has an undulating reticulated surface. The hysterosoma (fig. 1) bears 21 pairs of plumose setae which are situated in 8 transverse rows. Striae smooth except for those on the anterior margin of the hysterosoma and laterally on the prodorsum. Hysterosomal integument tuberculate (fig. 20).

**Venter** (figs 2–4 and 21–2). The genital opening (figs 2 and 21) is relatively large and the covers are clearly defined. Each cover bears 13–16 setae, of which the medial ones are obviously larger than the more laterally situated ones. The adult females can be divided into 2 groups depending on the number of internal genital setae. The holotype female as well as 17 of the female paratypes bears 2 pairs of internal setae (fig. 3) while 3 pairs are present in 6 of the female paratypes (fig. 4). There is also a slight difference in the leg chaetotaxy of these 2 groups. Eggs can be found in both groups. The females carry one egg each which is between 109–20 µm long. Three pairs of genital papillae (fig. 22) are present. One pair of small peg-like structures is present medially to the first pair of papillae. Six pairs of para-genital setae are present. The anal pore is surrounded by 5–7 pairs of anal setae and 5 or 6 pairs of para-anals.

**Gnathosoma** (figs 5–7). The palpal tarsus (fig. 5) bears 12 plumose setae, one obtuse solenidion and terminally one yatagan-shaped solenidion. The chelicerae (fig. 6)



Figs 7-14. *Terpnacarus glebulentus* spec. nov. 7. Hypognathum, female. 8. Genu, tibia & tarsus I, female. 9. Genu, tibia & tarsus II, female (group 2). 10. Tibia III, female. 12. Tarsus II, exceptional female. 13. Venter, tritonymph. 14. Venter, deutonymph.

are bulky, chelate-dentate and bear 2 setae dorsally. The hypognathum (fig. 7) bears 6 pairs of setae, the anterior pair small and nude and the second pair robust and truncate. The ectomalae (rutella) are well developed and each terminates in a sharp bladelike edge.

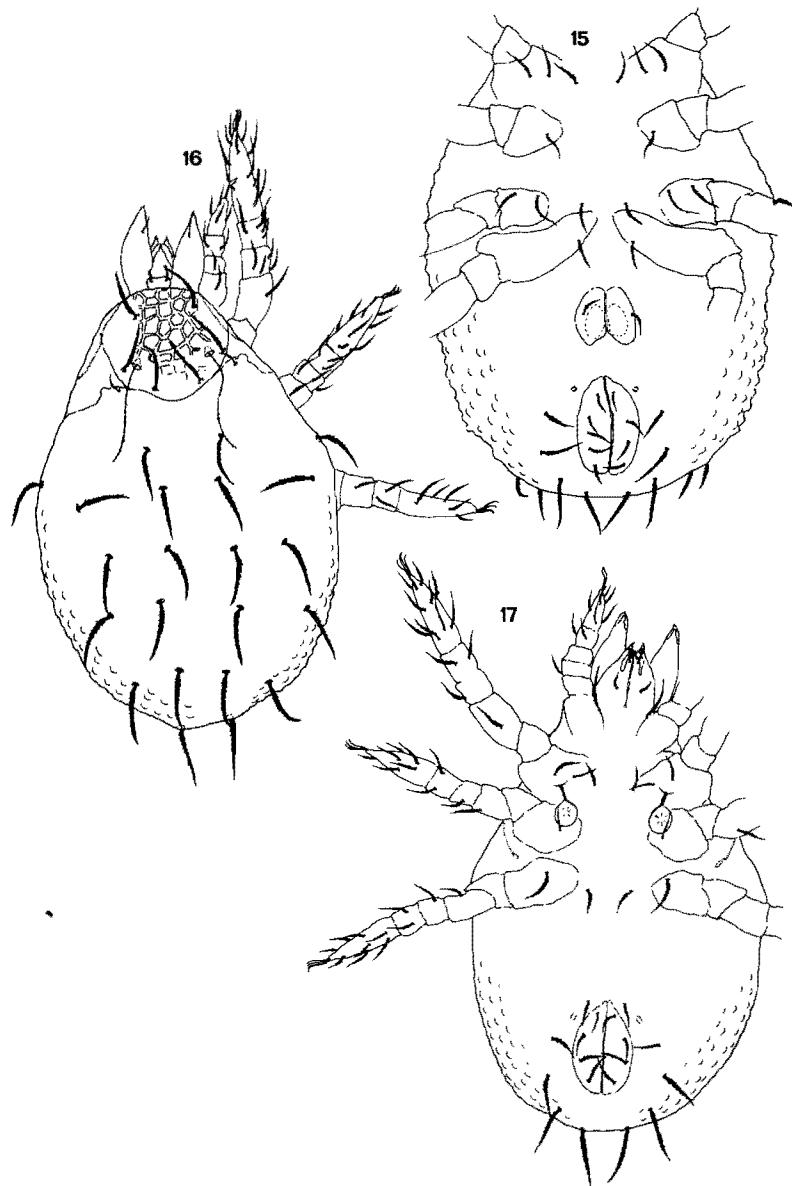
*Legs* (figs 8–12 and 23). Femora I and IV are completely divided whilst femur III is only partly divided. Leg IV, which is 253–6  $\mu\text{m}$  long (incl. coxae and claws) is adapted for jumping. Leg I is 181–5  $\mu\text{m}$  long; leg II 137–41  $\mu\text{m}$  and leg III 154–9  $\mu\text{m}$ . Formulae for the ordinary leg setae (with the variations indicated in parentheses): tarsi 23–19(17–18)–(17–18); tibiae 5(4–5)–3–4; genua 5–3–2–(2–3); femora (6–7)–(3–4)–3–4; trochanters 0–0–2–0; coxae 2–1–2–5. Tarsus I (fig. 8) bears one long, slender solenidion and one peglike famulus while tibia and genu I each have 3 slender solenidia. In the first group of females (those with 2 pairs of internal genital setae), tarsus II (fig. 9) bears one short, obtuse solenidion and one microsensory seta (famulus), while the same segment in the second group bears 2 short, obtuse solenidia and one famulus (fig. 10). Tibiae II and IV and genu II each bear one long slender solenidion. Tibia III (fig. 11) bears 2 solenidia of which one is very short and club-shaped. When studying this species the author found one female specimen in which tarsus II (fig. 12) bears only 12 ordinary setae, some of which are very short and unbranched. The ambulacra (fig. 23) of all the legs are composed of a large, rayed, clawlike empodium and two true claws which are barbed and smaller than the empodium.

#### MALE. Unknown.

**TRITONYMPH** (fig. 13). Dimensions: length of body (incl. gnathosoma) 323–60  $\mu\text{m}$ ; length of body (excl. gnathosoma) 269–300  $\mu\text{m}$ ; breadth of body 199–219  $\mu\text{m}$ . In dorsal aspect the tritonymph resembles the adult except for the dehiscence furrow which is present laterally on the prodorsum. The genital pore (fig. 13) is surrounded by 7 or 8 genital setae on each side and 4 pairs of para-genital setae. Three pairs of papillae are present. The hypognathum bears 5 pairs of setae. The counts for the setae of the leg segments are (with the sensory setae in parentheses): tarsi 21(2)–19(3)–17–17; tibiae 5(3)–5(1)–3(2)–4(1); genua 4(3)–3(1)–2–3; femora 5–4–3–4; trochanters 0–0–2–0; coxae 2–1–2–4. Tarsus II is provided with 2 short, obtuse solenidia and one small famulus thus resembling that of the second group of females, i.e. those with 3 pairs of internal genital setae.

**DEUTONYMPH** (fig. 14). Dimensions: length of body (incl. gnathosoma) 271–8  $\mu\text{m}$ ; length of body (excl. gnathosoma) 229–34  $\mu\text{m}$ . Dorsally, the hysterosoma bears 18 pairs of setae. The genital pore (fig. 14) bears 3 pairs of genital setae, one pair of para-genital setae and 2 pairs of papillae. Four pairs of setae are present on the hypognathum. The counts for the setae of the leg segments are (with the sensory setae in parentheses): tarsi 19(2)–15(2)–14–14; tibiae 5(3)–4(1)–3(2)–3(1); genua 3(3)–3(1)–2–2; femora 3–3–2–2; trochanters 0–0–1–0; coxae 2–1–2–3.

**PROTONYMPH** (fig. 15). Dimensions: length of body (incl. gnathosoma) 246–63  $\mu\text{m}$ ; length of body (excl. gnathosoma) 207–13  $\mu\text{m}$ ; breadth of body 119–33  $\mu\text{m}$ . The dorsal hysterosoma bears 14 pairs of setae situated in 6 transverse rows. One pair of genital setae and one pair of papillae are present. Four pairs of setae are present on the hypognathum. The counts for the setae of the leg segments are (with the sensory setae in parentheses): tarsi 18(2)–13(2)–12–7; tibiae 5(3)–4(1)–3(1)–0; genua 3(2)–



Figs 15-17. *Terpnacarus glebulentus* spec. nov. 15. Venter, protonymph. 16. Dorsum, larva. 17. Venter, larva.

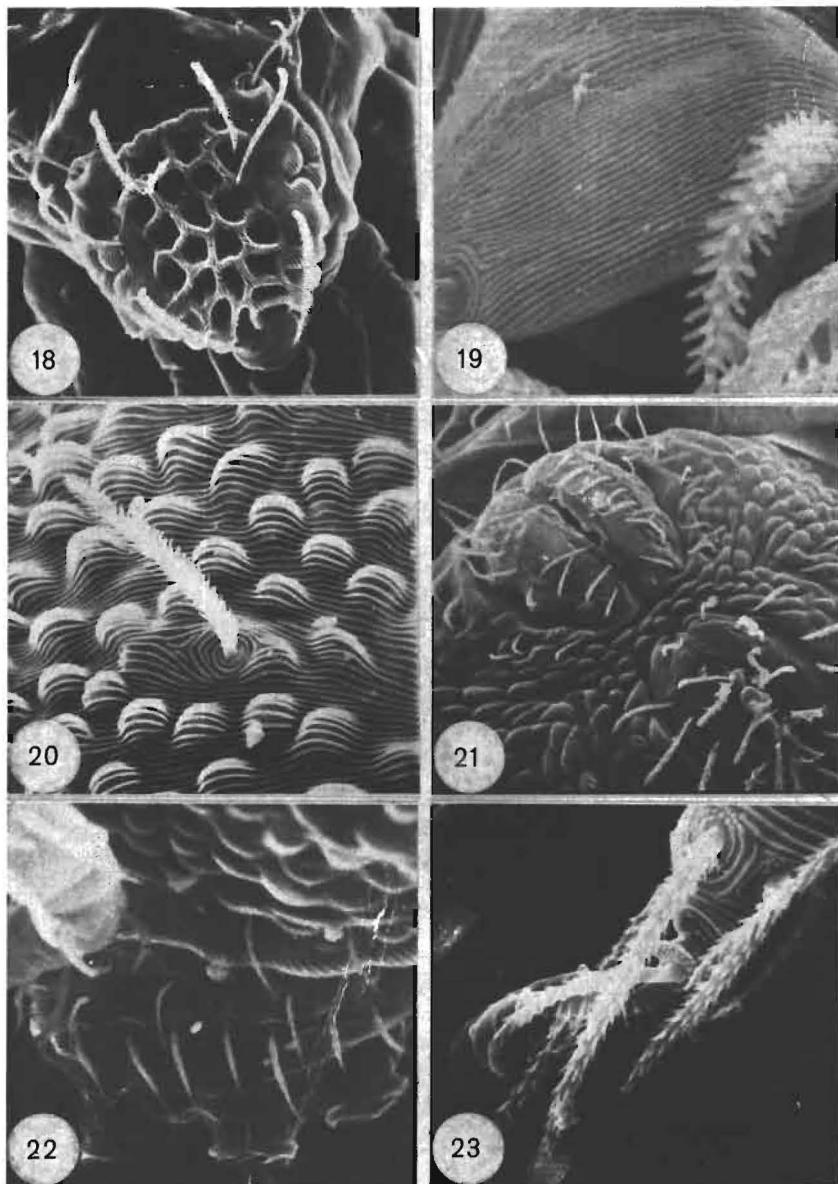
3(1)-2-0; femora 3-3-2-0; trochanters 0-0-0-0; coxae 2-1-2-1. The chaetotaxy of the pedipalpi is similar to that of the adult.

**LARVA** (figs 16-17). Dimensions: length of body (incl. gnathosoma) 206-99  $\mu\text{m}$ ; length of body (excl. gnathosoma) 169-89  $\mu\text{m}$ ; breadth of body 103-23  $\mu\text{m}$ . The dorsal hysterosoma bears 11 pairs of setae (fig. 16) arranged in 6 transverse rows. The prodorsum bears the normal 6 pairs of setae, and the dehiscence furrow is prominent. The integumental pattern is less prominent than that of the other immature stages. Three pairs of setae are present on the hypognathum, one pair of plumose setae and 2 pairs of adoral setae. The larval papillae (Claparède's organs) lie flush with coxae II but are attached to coxae I by means of seta-like stalks (fig. 17). The counts for the setae of the leg segments are (with the sensory setae in parentheses): tarsi 15(2)-13(2)-12; tibiae 5(2)-4(1)-3(2); genua 3(2)-3(1)-2; femora 2-2-2; trochanters 0-0-0; and coxae 2-1-1. The counts for the setae of the palpal segments are: 0-0-1-1-3-11(2).

**MATERIAL EXAMINED.** ♀-Holotype, 25 ♀-paratypes, 2 paratype tritonymphae, 2 paratype deutonymphae, 5 paratype protonymphae and 4 paratype larvae collected from soil in an *Acacia baileyana* biotope, Potchefstroom, Tvl., x.1970, P. D. Theron; 22 ♀-paratypes, 9 paratype tritonymphae, 5 paratype deutonymphae, 6 paratype protonymphae, 2 paratype larvae collected from soil covered by kikuyu grass (*Pennisetum clandestinum*) Potchefstroom, xi-xii.1971, P. D. Theron; 4 ♀-paratypes and one paratype tritonymph collected from pasture soil, Bloemhof, Tvl., 19.i.1972, P. D. Theron; 10 ♀-paratypes, 3 paratype tritonymphae, 5 paratype deutonymphae and 7 paratype protonymphae collected from debris under blue gum trees (*Eucalyptus globulus*) Jan Kempdorp, C.P., 19.i.1972, P. D. Theron; 4 ♀-paratypes and 2 paratype tritonymphae collected from cultivated soil, Middelburg, Tvl. 1.iv.1972, G. C. Loots; 2 ♀-paratypes, 3 paratype protonymphae and 2 paratype larvae collected from soil in an *Acacia karroo* biotope, district of Ottosdal, Tvl., 8.iv.1972, G. C. Loots; 7 ♀-paratypes collected from soil in a bamboo wood, district of Zeerust, Tvl., 12.v.1972, H. Basson.

**LIFE HISTORY.** Life history studies of *T. glebulentus* were undertaken during the summer of 1970-1. The mites were reared in flat-bottomed ointment jars (58 mm high and 32 mm in diameter) with vinyl-lined metal screw caps. Each jar was filled to 3 mm from the top with a 7:3 mixture of plaster of Paris and activated charcoal, which provided a smooth surface and made observations easier. One or two small wood splinters were placed in the centre of the container as refuges for the mites. A film of silicone grease was applied to the upper lip of the container to prevent them from escaping. The lids were never screwed down tightly. The temperature of the laboratory in which the cultures were kept ranged between 24° and 26°C. Several fungal species, including *Rhinocladiella anceps* Sacc. & Ellis and unidentified species of *Aspergillus* and *Penicillium*, could be seen within 48 hours after new culture cells were moulded. The fungal spores and hyphae served as food for the mites and no additional food was added. According to Huber (1958) the relative humidity in culture cells with plaster of Paris and activated charcoal as substrate, remains between 85 and 95%. Nevertheless, a few drops of water were added weekly.

The newly laid egg is shiny white, oval and about 109-20  $\mu\text{m}$  long. The eggs become progressively larger until the fifth day, when the six-legged larva emerges, and they are then about 150  $\mu\text{m}$  long. Movement of the larva can be seen inside the egg-membrane some hours before emergence. The newly emerged larva moves about



Figs 18-23. *Terpnacarus glebientus* spec. nov. 18. Propodosoma. 19. Naso with median eye. 20. Hysterosomal integument. 21. Genito-anal field. 22. Genital opening. 23. Ambulacrum, leg I.

slowly and continuously, but whether it feeds could not be determined. After 80–110 hours the larva becomes quiescent (the pre-moulting stage) and it remains like that for about 24 hours, during which time it changes from the normal off-white colour to a pale yellow. Frequently, this period was spent under or near the wood splinters, which afford protection. Moulting commences with the movement of the pedipalpi and first pair of legs. The old cuticle splits on the dehiscence-furrow laterally over the prodorsum towards the level of coxae II. Within 1–3 hours the protonymph wriggles itself from the exuviae. The eight-legged protonymph is off-white in colour, moves about actively and like all later stages it feeds on the fungal spores and hyphae. The protonymphal stage lasts for 60–72 hours, and active moulting starts after a pre-moulting period of 24–36 hours.

The deutonymphal stage lasts for about 48 hours and the ensuing pre-moulting stage continues for another 30–6 hours. In this, and the other stages, the active moulting process takes about 1–3 hours. The tritonymph, which is about the same size as the female, moves about for 36–48 hours before it enters the pre-moulting stage, which lasts for 40–48 hours. Moulting is completed within 2–3 hours. The duration of the pre-moulting period thus becomes progressively longer from the first to the last nymphal instar.

The adult female moves about and feeds continuously and, like the nymphal stages shows no tendency to aggregate. Two individuals contacting each other immediately move apart at an increased pace. Two or three eggs are laid 60–80 hours after the female emerges from the nymphal exuviae. The eggs are often suspended among the fungal hyphae but occasionally are deposited onto the substrate. Within 24–30 hours another 3–4 eggs are laid. Most of the females observed laid a total of 7 eggs, but some laid as many as 13. The female dies 7–10 days after the last eggs are produced.

In the laboratory, the life cycle of this species was completed in 26–32 days agreeing with observations on the primitive oribatei (Woodring & Cook, 1962).

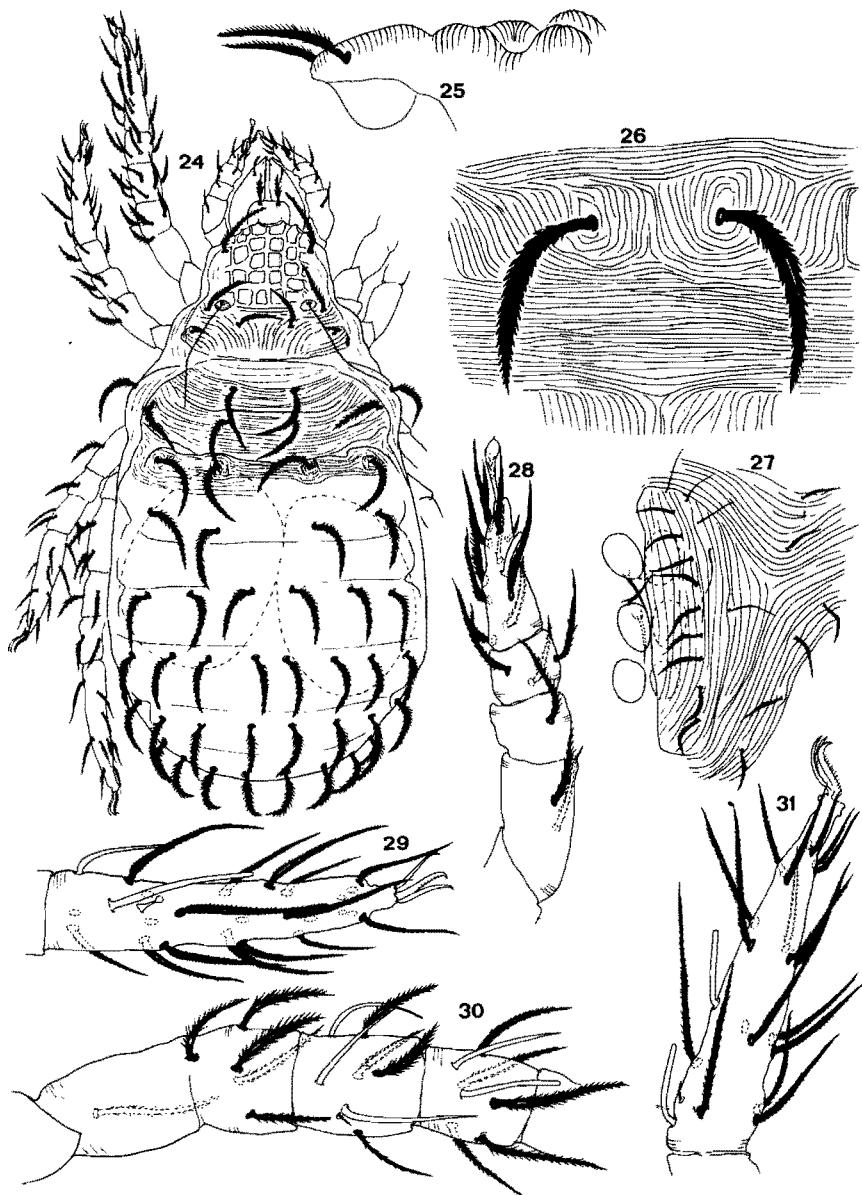
During this study, newly deposited eggs were transferred to fresh culture cells (one egg for each cell), and although this was continued for nine generations, each egg developed into an adult female. The indication is that males probably do not exist and that reproduction is entirely parthenogenetic.

#### *Terpnacarus carolinaensis* spec. nov., figs 24–31.

This species is more closely related to *T. bouvieri* Grandjean than to *T. variolus* Shiba or *T. glebulentus* spec. nov. However, it can be separated from the former by the details of the prodorsum and by the hysterosomal setae, which are larger and more numerous.

FEMALE (figs 24–31). Dimensions: length of body (incl. gnathosoma) 351–4  $\mu\text{m}$ ; length of body (excl. gnathosoma) 306–13  $\mu\text{m}$ ; breadth of body 140–66  $\mu\text{m}$ .

Dorsum (figs 24–6). The prodorsum bears the normal 6 pairs of setae (fig. 24). Setae *le* are distinctly larger than setae *xa* and *in*. The naso is distinctly larger than that of *T. glebulentus* and also bears a lenslike eye ventrally (fig. 25). The lateral eyes are situated immediately lateral to setae *xp*, which are very small. The prodorsal integument exhibits the same undulating reticulated pattern as that of *T. glebulentus*. The hysterosoma is more tapered than that of the latter species and bears 23 pairs of curved, plumose setae arranged in 8 transverse rows. The integumental striae are fine and smooth, mostly running transversely (fig. 26).



Figs 24-31. *Terpnacarus carolinaensis* spec. nov. female. 24. Dorsum. 25. Naso with median eye. 26. Hysterosomal integument. 27. Genital opening. 28. Palp. 29. Tarsus I. 30. Femur, genu and tibia I. 31. Tarsus II.

*Venter* (fig. 27). Six pairs of para-genital setae surround the genital opening. Each genital cover bears 14–15 setae, of which 9–10 are pilose and arranged in a row next to the genital slit, while the remaining 5 are very thin, nude and situated more laterally. Three pairs of genital papillae as well as 3 pairs of long nude internal setae are present. The holotype female carries 2 eggs, respectively 106 µm and 109 µm long. Five to 7 pairs of anal setae and 6 pairs of para-anal setae are present.

*Gnathosoma* (fig. 28). The chelicerae and hypognathum are identical to those of *T. glebulentus*. The palpal tarsus (fig. 28) bears 11 plumose setae, one obtuse solenidion and terminally one yatagan-shaped solenidion.

*Legs* (figs 29–31). The legs are relatively long and leg IV is adapted for jumping. Femur I is completely divided; femora III and IV are only partly divided. The counts for the setae of the leg segments are (with the sensory setae in parentheses): tarsi 23(3)–19(3)–18–17; tibiae 5(2)–5(1)–3(1)–3(1); genua 4(4)–3(1)–2–3; femora 6–4–3–4; trochanters 0–0–2–0; coxae 1–1–2–3. Tarsus I (fig. 29) bears 2 solenidia, one obtuse and the other mucronate, together with a club-shaped famulus. Tibia I (fig. 30) bears one obtuse and one mucronate solenidion while genu I bears 3 mucronate solenidia and one peglike microsensory seta which is situated adjacent to one of the solenidia. Tarsus II (fig. 31), bears 2 obtuse solenidia (longer than those of *T. glebulentus*) together with one microsensory seta. Tibiae III and IV and genu I each have a single mucronate solenidion, while tibia II has one obtuse solenidion. The claws and empodium are similar to those of *T. glebulentus*.

MATERIAL EXAMINED ♀-Holotype and 4 ♀-paratypes collected from soil in an *Acacia karroo* biotope, Potchefstroom, Tvl., xi. 1969, P. D. Theron; 2 ♀-paratypes collected from soil on the bank of the Komati River, Carolina, Tvl., 26.iv.1972, K. N. de Kock.

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